



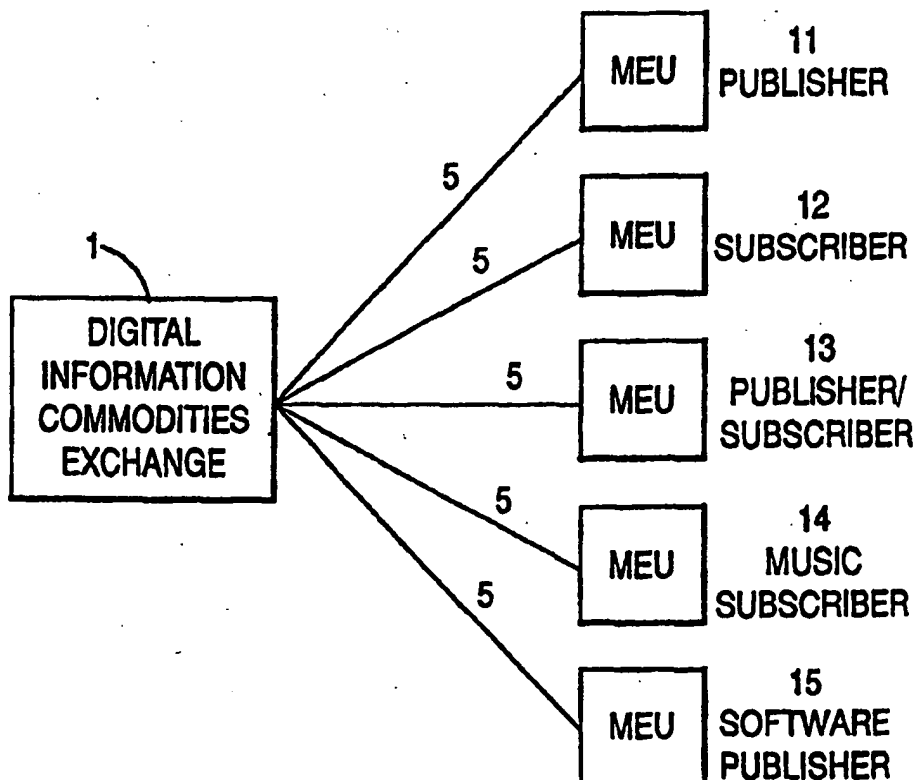
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(54) Title: **DIGITAL INFORMATION COMMODITIES EXCHANGE WITH VIRTUAL MENUING**

## (57) Abstract

A system for the exchange of digital information packets includes an exchange (1) with connectors to allow modular expandable units (11-15) to connect to the exchange over transmission media (5). The modular expandable units (11-15) send digital information packets from one to another over the exchange (1) in response to requests for these digital information packets. The exchange (1) allows for billing and other administrative functions. A virtual menuing system is disclosed for use with the exchange (1) allowing a simple choice of digital information packets to be published and/or subscribed to.



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**DIGITAL INFORMATION COMMODITIES EXCHANGE  
WITH VIRTUAL MENUING**

**FIELD OF THE INVENTION**

5       The present invention relates generally to an information network and menuing system, and more particularly to a digital information exchange system (DICE) where users can send and receive multiple types of data with a virtual menu.

10   **BACKGROUND OF THE INVENTION**

15       A multitude of electronic bulletin boards are in use today. Such bulletin boards generally consist of a particular type of data and are geared to a particular market. Generally, a subscriber has an interest in a particular subject, connects to a bulletin board corresponding to that subject, and retrieves information from it. Occasionally a subscriber may leave information on a bulletin board, either for use by another subscriber or to an administrator of the board. Generally, the flow of information is downstream, i.e., from the board to the subscriber.

20       For the purpose of this discussion, a person is referred to as subscriber if they are receiving information. A person or entity who is supplying information is referred to as a publisher.

25       The current paradigm under which these bulletin board systems operate requires that a subscriber own a computer system with which to connect to the bulletin

board. Such a computer system usually requires a CPU, a keyboard, and a CRT or other display device. A subscriber generally "downloads" information from the on-line system's service to his or her private computer system. The information is generally usable only within the context of the computer system. Examples of such information include executable computer software (particular to certain types of computers) and data files that are understood by programs which run on the subscriber's computer and which contain information (e.g., a graphical image or sound clip). It is very difficult, at best, for a subscriber to use the information received from the on-line system outside of the bounds of a computer system.

Different commercial embodiments of electronic bulletin boards vary in the types of digital data used. However, they are similar in the direction of the flow of data. For example, the Prodigy® and CompuServe® systems are popular news and entertainment services. With the exception of their electronic mail, shopping, and billing, the flow of information is towards the subscriber. Similarly, the Audio Archive in Syracuse, New York, provides hundreds of thousands of downloadable audio recordings to subscribers. The only information sent upstream by the subscriber to the Archive is the choice of recording.

Under present distribution systems, such as cable TV networks, downstream flow is the norm. A cable subscriber is simply presently incapable of sending the same type and quantity of data in the reverse direction. At best, current interactive cable systems in testing stages allow for a minimal backchannel to allow subscribers to send selection data to a collection or centrally located video server device. With on-line services such as CompuServe®, the parties involved in the transaction are forced to store their data on

Compuserve®'s computers. If Compuserve® computers went off-line, so would all of its subscribers.

There are also a number of prior art patents disclosing such a downstream, unidirectional flow of data, e.g., U.S. Patent No. 5,132,992 to Yurt et al., U.S. Patent No. 4,326,289 to Dickinson, and U.S. Patent No. 4,491,983 to Pinnow.

The above systems demonstrate a basic limitation of the traditional digital communications system, namely, the subscriber is limited to a particular library and is limited to a particular data type. In addition, the subscriber must access a library with a particular device such as a computer, or with a subscriber interface module (SIM).

There is a need for a system in which a vast number of participants can act as providers as well as consumers of data, in the manner of a commodities exchange. Such a system would give rise to a much larger number of producers of data than is presently available. This could ultimately provide a wider range of information topics available to information seekers and would provide more of an information marketplace.

It would also be desirable and possible to provide data for almost any and every interest. In essence, one could provide a multimedia system in which all types of digital data (music, text, moving video, virtual reality, etc.) could be published and subsequently subscribed to by consumers using their information or entertainment system, and which could be expanded to adapt to different data types thereby further expanding the digital information marketplace.

Such a system would be modular and provide that the failure of any one unit would not preclude other subscribers from making use of the system.

Three problems, at least, are addressed:

1. The difficulty encountered by individual subscribers who wish to publish data, whether for

commercial or private purposes, which are in part caused by the paradigm of archive/download and implemented in hub-oriented networks.

2. The limitation imposed by current systems wherein data addressed via the system is useless (digitally) outside the system and/or SIM, either because it has no meaning or because it cannot be easily transferred out.

3. The slowness of data transfer across only one transmission line. In particular, transmission times are made faster by using parallel transmission techniques across distinct transmission media.

The invention as disclosed and claimed further includes details of the specific processing method for implementing an information service menu (for computers and other similar devices) between the host device and a remote client device connected by an arbitrary telecommunications link.

The use of the disclosed menu invention represents an improvement in the art in, e.g., the specific areas of efficiency of transmission and flexibility of presentation.

The current state of the art in computer systems and telecommunications technology includes rapidly proliferating on-line services, remote operation and navigation of information systems, to provide a remote host or server which communicates via telecommunication lines with various clients. One aspect of such systems, from modern graphical interfaces to ASCII-only technologies, is the use of menus to facilitate interaction between the host and the users of the client machines. Typically, a menu has a list of items, characterized by an ASCII text label for each, which provides an intuitive description of the choices available to a user. The selection of such an item, which may be associated with a fixed numeral to provide a shorthand method of identifying it, is communicated

from the client to the host which then causes some action associated with the item in question to take place. In the context of a graphical user interface, such as Windows or the Macintosh OS, various embellishments such as special fonts or icons may be added to the presentation of such menus, and the display of the menu as a whole may be packaged into some graphical enclosure construct in order to separate menu items from surrounding information.

Menus can furthermore be hierarchical. That is, they may contain items which themselves represent submenus.

A typical example of such a menuing system is that used by the on-line service America On-Line (AOL). AOL has two basic types of menus. In particular, AOL presents various screens having several icons (graphical devices used in place of traditional text labels). To select an item, the user clicks on an icon with a graphical pointing device such as a mouse. Although this looks much different from a traditional text based menu, it implements the same function. By clicking on the various icons, the user can navigate to various content-specific areas of the host information system in a trigger action such as query processing or the inputting of additional information from the user. In addition, and often in combination with the icon-based menu, AOL also uses more traditional text-based menus.

One problem encountered with systems like AOL is that menus are typically of unpredictable length as they may change with added content and very often they are quite long. This may prove a liability if the communications medium between client and host is bandwidth limited. A noticeable delay occurs should the entire menu be sent from the host to the client. AOL works around this limitation by only transmitting only a portion of a long menu at a time. Thus, a long menu may be broken into several shorter chunks. Additional chunks

are sent only when the user attempts to navigate past the last item received. AOL also works around the platform-specific issues by arranging the storage of frequently used platform-specific icons and other such information with its client-local interface on the client. One way of accomplishing this is the use of coded information in the stream of host to client which specifies an icon to look up in the client's data base. The client software determines if it does not have the item, it asks the host to send it, at which time it is added to the client data base for future use and displayed accordingly.

This system also has several limitations. First, a user must often endure the delay should they wish to access a menu item at the end of a long menu. They must wait patiently as each chunk is downloaded in turn. They receive no direct indication as to how many more items they must transverse to reach the end of a menu, or how many more chunks must be downloaded. Second, should a user navigate to the end of a long menu, the entire menu is now in memory at the client, although the user may only be interested in a single item. On current PC platforms, the amount of memory occupied by a menu may seem insignificant compared to the total content, but in smaller, portable devices, any memory optimization is valuable. Third, the client is responsible for archiving menu embellishments such as icons, which may occupy valuable non-volatile storage space.

It is therefore an object of the present invention to implement a menuing system which has the properties of increased efficiency and having an information content which is independent of the modality of which the content will be presented. It is also desired to add contents specific to modality, without restricting the usefulness of the information stream as a whole. It is also an object to send an information stream (such as a menu) to a client running one of any number of different operating systems with graphical interfaces, or even to a client



who does not have the benefit of such a graphical interface, and to have the stream interpreted correctly, without the necessity of each client's platform-specific software having to interpret information specific to another platform. At the same time, the additional information for use in the system should be available to leverage any advantages inherent in the target system. For instance, a menu to be received by a Macintosh might contain information representing an icon associated with each item, and a screen position at which to display the icon, while this information would be useless to a non-Macintosh platform.

One benefit of such a system is that it can remove a significant amount of processing necessary at the host to deal efficiently with clients of varying platforms. The same menu information stream could be sent to various types of clients without the need to alter the information stream according to the client. A minimal level of functionality is guaranteed at the client, while the host can opt to provide additional functionality in the stream according to its resources (such as storage space or processing speed) or lack of them.

#### Summary of the Invention

The invention disclosed herein includes a method for employing software to use a virtual menuing system. Specific implementation of those common computer interface components such as menus is disclosed which possesses the properties discussed above and as such represents an improvement in the art.

The present invention is also directed to the problem of developing a digital information commodities exchange in which the data flow is bidirectional rather than unidirectional and in which subscribers can exchange information with each other through the system. A subscriber could just as easily send the same type and quantity of information as he can receive; thus, making

them a publisher. The present invention is also directed to the problem of accommodating different data types within the same modular system, thus allowing for an exchange of a virtually unlimited range of digital commodities. In addition, the present invention provides for the automated conversion and transfer of arbitrary formats beyond the SIM.

The present invention removes the limitations of the electronic bulletin boards described above in the following way. An exchange system is provided, but it is not the ultimate source of any data itself. The exchange system is simply a conduit through which users can perform digital transactions. To further support the development of a data marketplace, the exchange can provide administrative functions such as billing. In addition, transactions are not required to pass through a particular publisher or exchange, therefore, allowing any publisher and subscriber to also communicate directly.

These digital transactions are facilitated by modular expandable units (MEU) operated by publishers and subscribers. A publisher makes a publication available to the exchange via the publisher's own modular expandable unit. Likewise, a subscriber can then subscribe to this publication, using his or her own modular expandable unit, by contacting the exchange to receive the desired publication. Those who wish to use the system as publishers can attach electronic devices to the system which can act as archives specific to the information that the publishers wish to provide, on a case by case basis. However, in no case would subscribers be required to route their transactions through devices belonging to any particular publisher. Any such transaction (publication or subscription) may result in charges to both or neither or either of the parties involved. Because the system is a true bilateral exchange, any supplier can be a subscriber and similarly

any subscriber can be a supplier. The modular expandable units enable the publisher/subscriber to upload and download data in a variety of formats, such as music, text, and computer programs (e.g., personal computer programs, Nintendo programs, etc.) via their inherent expandability. The modular expandable units are also expandable with respect to the form of data transmission, so as to accommodate telephone, satellite, electric power lines, CATV, cellular or fiber optic communications.

10 In a DICE exchange network, if an MEU or general archival device goes off-line, only that device and any subscribers connected to it are affected. The affected subscribers are immediately free to try to obtain the desired data via another source, since their MEUs are  
15 still fully functional. This is clearly an improvement over the phone, cable, on-line, or digital packet switching networks described in the prior art.

The MEUs enable users to upload or download data in a variety of formats (such as music, text, computer programs, graphics, Nintendo games, etc.) through their expandable architecture. MEUs are electronic devices characterized by an internal data bus, (or multiple buses) connected to a multiplicity of expansion interface slots. A specific protocol is used to move data between  
20 a variety of expansion modules which may be connected to the bus via the expansion interface slots. This protocol is always the same no matter the specific circuitry of an expansion module plugged into a slot. Each of these modules, in turn, may be capable of converting data  
25 received from the MEU's internal bus to a specific format to be outputted from a plug, connector, or other external interface (also part of the expansion module). Similarly, the expansion module may receive data from an external device via the external interface, convert it to  
30 the MEU internal protocol, which then transmits it to another distinct expansion module attached to the MEU's bus(es).

For example, MEU expansion modules can be made available for each of the following data transmission standards: NTSC Video, Optical Digital, Audio, Two-channel Stereo, Audio, Appletalk, Ten Base-T Ethernet, Thin Ethernet, Thick Ethernet, Token Range, Coaxial Cable TV, Analog Cellular, TVMA Cellular, CVMA Cellular, and so on. The idea is to establish an internal standard capable of delivering a throughput sufficient for any digital application, and then to provide translators for any established standard deemed common enough to merit inclusion. The MEU itself speaks none of those standards internally, but merely moves raw data between one standard and another, at the will of its users. In short, the MEU is a device with an architecture that makes no assumptions about what type of data it is handling internally, but allows for additional specialized circuitry to be added as easily as inserting a bank card in an ATM machine, thus, providing an expandability to other and new data transmission formats as they gain acceptance, even though they may not have existed when the MEU design was finished.

The MEU design also anticipates benefits from multiprocessing. All data processing will occur in microprocessors attached to the expansion modules. Each expansion module may in fact house a complete, encapsulated data processing environment, including memory, microprocessors, and other special purpose IC's like digital signal processors. MEUs with one or several expansion modules containing microprocessors could take advantage of multiple data buses and multiple communication lines connected to the expansion modules' external interfaces to break up a large chunk of data into several smaller discrete component data chunks, and transmit them simultaneously over several distinct lines of communications, after which they may be reassembled into a single coherent chunk of data by a similarly equipped MEU which is receiving the data. This method of

simultaneous transmission should be distinguished from the parallel computer interface, which transmits simultaneous bit streams over several distinct strands of wire which are all bound together in a single cable. The difference is that each of those bit streams are governed by the same protocol and, if one wire breaks, any transmission over this interface is impossible. The method to be employed by MEUs splits a data stream over multiple channels, each having its own protocol, possibly distinct physical transport, and which may have distinct protocols. If any one of the multiple channels fails, the MEU can continue, simply by eliminating that channel from consideration.

#### 15 BRIEF DESCRIPTION OF THE DRAWINGS

FIG 1 shows the layout of a small data exchange network in accordance with an embodiment of the present invention, as well as each consumer's intended use.

20 FIG 2 shows the implementation of a data exchange system with three hubs. Several networks are attached to each hub.

FIG 3 shows a typical publisher/subscriber connection in an embodiment of the present invention.

25 FIG 4 shows a modular expandable unit, including its base system, communications converters, and expansion modules according to an embodiment of the present invention.

#### DETAILED DESCRIPTION

30 The method and apparatus of the present invention will be described using an example of a digital information commodities exchange. However, the present invention is not limited to the exchange of the specific digital information described below.

35 In a digital information commodities exchange operating according to the present invention, the exchange commodity comprises digital information packets.

The information, which can represent a variety of different kinds of data, is encoded in a standard format by an expandable modular unit operated by the publisher/subscriber:

5       A commodities exchange includes a system capable of performing at least four functions: receiving/storing notification of the availability of a particular digital information packet, receiving/storing a digital information packet from a publisher, sending a digital  
10 information packet to a subscriber, and maintaining records of a subscriber and/or publisher transaction.

      A publisher transmits a notification of the availability of a digital information packet to the exchange. The publisher may also notify subscribers  
15 directly of the availability of such information in a variety of ways. The publisher can, for example, advertise within the exchange itself or in any other medium such as print (e.g. newspapers). A subscriber can then request transmission of such a packet from the  
20 publisher. This publish/subscribe transaction could occur in real time, e.g., the subscriber could achieve access to a live concert, or it could be separated in time, e.g., a subscriber could access a video game that had been published weeks or months earlier. In either  
25 case, the publisher transmits the digital information packet over the selected transmission medium to the exchange. To perform the publication transmission, the publisher is connected to the exchange system using a modular expandable unit (MEU) and over the transmission  
30 medium of his or her choice. Likewise, the subscriber is connected to the exchange using a modular expandable unit and the medium of his or her choice. However, one MEU can send information directly to another MEU without being connected to the exchange over dedicated lines.  
35 Furthermore, these lines do not have to be packet switched.

Upon receipt of a digital information packet from the publisher, the exchange system can send the packet to the requesting subscriber. The subscriber requests a particular packet using a simple menu-driven process  
5 jointly administered by the subscriber's modular expandable unit and the exchange system. To receive the transmission, the subscriber is also connected to the exchange system through his or her own modular expandable unit.

10 The exchange system includes a network of computers (that may be geographically dispersed) and the communications devices to send and receive various data over various media.

Fig. 1 exhibits a proposed embodiment where the  
15 digital information commodities exchange is connected to a number of publishers and subscribers. For the sake of illustration only five users are shown. Element 1 is a commodities exchange system which has the ability to handle many simultaneous publication/subscription  
20 sessions. Element 11 is a modular expandable unit of a publisher of digital information packets. In this instance the packets produced by publisher's unit 11 relate to audio data such as music. Element 12 is a modular expandable unit of a home subscriber who can  
25 receive data in a variety of forms, including text, audio, video or computer program data. Element 13 is the modular expandable unit of a user who intends to both subscribe and publish digital information packets, in particular audio information. Element 14 is the modular  
30 expandable unit of a subscriber who intends to receive music to dub onto his or her own home video tapes. Finally, element 15 is the modular expandable unit of a publisher of digital information packets for hand-held computer games. Initially the publisher 11, using his or  
35 her own modular expandable unit, contacts the exchange to make a publication request and to register the publication parameters: artist, title, pricing,

marketing plan, etc. This is accomplished via point selections from menus on the modular expandable unit which is interacting with the exchange. At this point the publisher may wait for a request from a subscriber.

5 Alternatively, depending on the storage capabilities of the exchange, the publisher may wish to store his or her publication on the exchange so that it would be immediately available to subscribers. In this situation a publication-recording session must occur. The

10 publisher 11 might have recorded the audio publication on digital audio tape and would then play and transmit it to the exchange via his or her modular expandable unit and the transmission medium of his or her choice. Alternatively, the publisher may elect to transmit live

15 via an analog-to-digital conversion system to the exchange. In either case the session would be played to completion and stored on the exchange at an appropriate address whereupon the publisher would indicate termination by a signal from the modular exchange unit

20 and the exchange confirming the same.

The subscriber of element 14, after learning of the newly available digital information packet, in this example music, would then use his or her modular expandable unit to make a subscription request to the

25 exchange, using the transmission medium he or she prefers. Again, by moving through a series of menus that refine his or her choices, the subscriber chooses the desired music item. The first menu might list music as one category of available packets, the second menu might

30 list styles of music, the third might list particular artists, the fourth might list an artist's albums and the fifth menu might be a list of the songs on a particular album. A particular song, group of songs or an entire album may be subscribed to as a single digital

35 information packet.

After the subscriber has selected the particular digital information packet which he or she would like to



receive, the exchange 1 receives the request, notifies the publisher's computer (or modular expandable unit) that the digital information packet is to be transferred, prepares the selection for transmission, confirms that  
5 the subscriber's modular expandable unit is ready, and proceeds to transmit the selected digital information packet. The quality of this publication will depend on the quality of the publisher's recording equipment and likewise the quality of the subscription depends on the  
10 subscriber's equipment.

FIG 2 exhibits a similar system as FIG 1, but on a considerably larger scale. In this figure, several different exchanges 1 are illustrated, each with an arbitrary number of modular expandable units 13 attached  
15 to it. This figure also illustrates that a single exchange 1 can be connected to other exchanges 1, as well as to other MEUs. In this way the network can spread in a horizontal sense so as not to overburden a single exchange with too many units 13. Also, the network can  
20 spread in a vertical sense by nesting one exchange within another. Note that this configuration allows the network to incorporate and complement existing systems, such as Compuserve®, etc.

As is evident in FIG 2, a distinguishing feature of  
25 the exchange of the present invention and other exchanges or networks lies in the administrative functions the exchange performs. Each exchange has a user directory 41 and a digital information packet directory 42. Digital information packet directory 42 does not contain the  
30 actual packets themselves, but rather is a list of where the packets are located on the exchange. The user directory 41 is a list of which users are located at which addresses on the exchange. In contrast, networks not of the present invention, denoted 50 in FIG 2, need  
35 only have a user directory 41. This is because their "digital information packets" are contained within their central singular computer rather than distributed amongst

many different digital commodities 'brokers' 13. Finally, it is important to note that user 13 is not limited to those digital information packets located in the directory 42 of his or her own particular exchange 1.

5 This is because a particular exchange 1 may also search other exchanges throughout the system for a particular requested digital information packet. This packet could then be sent to the user in a manner completely analogous to the transfer of a packet from a publisher to a  
10 subscriber.

Although the best quality recording is stored on a master tape originally made at the studio, exceptionally high quality reproductions can be achieved after a conversion to a compact disk standard format (CD). Thus,  
15 it is likely that the publisher will upload the reproduction from a compact disk. While a typical CD player would convert the data from a digital format to an analog format before sending it to the amplifier, in this case the signal could be removed from the CD player at 31  
20 in a digital format and could be directed to the modular expandable unit's expansion module in that same format. The expansion module 32 provides the necessary connectors to interface the CD player with the modular expandable unit through the control unit 33. The modular expandable  
25 unit can then provide any necessary data compression. The signal can then be sent over a telephone line 5 via a modem, with the modem also providing the necessary conversion to an analog format. If, in the alternative, a fiberoptic cable were employed, the data could remain  
30 in digital format.

The maximum amount of information to be sent can be calculated as follows. Using a band width of 3300 Hz and a signal-to-noise ratio of 20 dB, it is estimated that a telephone channel can handle about 22,000 bits of data  
35 per second. Standard modems today have bit rates of up to 19,200 bits per second. Use of an ISDN standard and digital switches would allow a rate of up to 64,000 bits

per second to be achieved. A compact disk player, handling the audio frequency range of up to 20 kHz, and taking into account the Nyquist frequency of the disk player and the need for two channels for stereo sound, would require about 80,000 bytes per second. The large data rate mismatch would require, on the publisher's side, a buffer 32, as depicted in FIG 3, to store data prior to the data being sent over the telephone line. The size of the buffer would depend on the length of the digital information packet to be sent. Once the data is buffered and sent over the telephone line, a buffer 23 on the subscriber's side would restore the data to its original rate. The data could then be stored in a variety of forms. Each buffer 23 forms part of its modular expandable unit. The expansion module 24 could be equipped with both digital and analog outputs. The digital output emerges directly from the modem. The analog output is simply the digital output after processing by a digital-to-analog converter. In the present example, the signal can then be sent into either a digital or analog input of a digital audio tape player.

In the course of buffering the data, compression techniques can be used to speed the transfer. Other techniques, such as storing the data on RAM chips, can be used to minimize the time necessary to maintain the telephone connection. Additionally, if a fiberoptic link is used to transfer the data, the wide band afforded by the fiberoptic would allow the packet to be sent even more expeditiously.

Publishers and subscribers can be connected to the exchange system over any one of a variety of transmission media 5. For example, they may choose to be connected to the exchange system over private circuits, television lines, the public switched telephone network, cellular communications, electric power lines, or even satellite communications. Depending on the type and amount of data

to be sent, some of the digital information packets could be sent over one type of medium and simultaneously another part could be sent over a different type of medium. For example, if a movie were to be transmitted to a subscriber, the audio portion of the movie contains considerably less information than the video. Thus, the telephone line, with its limited band width, is sufficient to transmit the audio portion of the movie. A higher band width transmission medium such as a fiberoptic, a cable TV line, or a power line could be used to transmit the video, thus allowing a more rapid transfer of a digital information packet. The exchange provides this versatility by being equipped with a large variety of transmitters/receivers interfaced to many types of transmission media.

The exchange system is capable of performing administrative functions with respect to the publication/subscription transactions. The exchange system interacts with publishers and subscribers via menu-driven software so that the users can easily perform the desired transactions. The exchange system can also maintain profiles of subscribers and their usage in such a way that subscribers may be kept informed of newly available digital information packets that may be of particular interest. Publishers may be kept informed of who is subscribing to their publications and any other relevant market information. To support the exchange system, transaction fees may be charged to either the publisher, the subscriber, or both. Furthermore, the exchange system can track the publications and subscriptions so that either the exchange system or the publisher can bill the subscriber for the price of the digital information packets. The exchange can provide many options regarding the commercial aspects of the digital information commodity exchange. For instance, various price mechanisms can be supported. In this way the subscriber can be charged less per packet for

ordering a higher quantity of data, or alternatively can be charged less for ordering a data reproduction of lesser quality. For example, a video for use on standard televisions would cost less than one for use on high-definition televisions. Some publishers would pay to have their publications subscribed to. An example might be a car company who would issue an exchange credit for the first 1000 subscribers who receive their video of a test drive of the company's new luxury car. Similarly, receiving a live lecture from a Nobel Laureate might cost more than receiving the same lecture pre-recorded.

FIG 4 schematically illustrates a modular expandable unit. A modular expandable unit can provide the interface to the exchange system for either a publisher or a subscriber. A modular expandable unit includes a central processing unit and various expansion modules 24. The central processing unit includes an input, an output, a serial line for connecting the input to the output, software running on a microprocessor which may be used to select which digital information is desired, and a system for entering commands. The software system can be in the form of microcode or can utilize other known techniques such as EPROM. Obviously contrary to some popular usage, the term central processing unit as used here encompasses more than just a microprocessor. A base system of the modular expandable unit is used to send requests to the exchange and may include a small video screen 22, an apparatus for inputting commands 26 (e.g., a keyboard or a pointing device), and software for user interaction. In addition, the MEU is capable of accepting input and output from several known techniques such as a keyboard, a CRT, a modem, etc. The software serves to configure the hardware and to control the conversion of data with the appropriate add-on communication module. The unit is also capable of sending digital information packets to the exchange system, receiving digital information packets from the exchange system, reformatting data

received from the exchange system for replaying on a specific device, and playing or recording digital information packets thus received.

5 The modular expandable unit is capable of sending and receiving digital information packets to and from the exchange system over a selected transmission medium 5. If the transmission along a particular data link fails, it does not preclude the parties in that link from immediately re-establishing the connection in another link. The unit may also have a variety of expansion modules 24 available, some of which serve to format a particular data type and others which serve to adapt the modular expandable unit with a particular transmission medium. For example, if a publisher wants to send a digital information packet from a digital audio tape (DAT) over an ISDN connection to the exchange, the MEU would have an expansion module 24 allowing the MEU to interface to an appropriate DAT device and would have an expansion module to interface to the ISDN circuit. The data coming from the DAT device would be received by the expansion module, reformatted and buffered, as necessary, by the unit and then the modular expandable unit would send the data to the exchange system 1 over the selected transmission medium 5. Examples of appropriate expansion modules 24 for audio data are those that accommodate devices using digital audio tapes, digital compact cassettes, analog speakers, analog cassettes, 9-track tapes, and telephones, however, other expansion modules might be used. Standard interfaces also exist for other data types: NTSC video, serial/parallel PC, Group III fax, etc.

In the example noted above, the subscriber at element 13 received a digital information packet from a publisher at 11. This same subscriber may wish to send a digital information packet to the publisher for review, and perhaps future publication. Thus, the consumer at element 13 will then in turn be acting as a publisher.

If the consumer at element 13 is a relatively small publisher, the manufacturing technology of producing a compact disk may be unavailable. He or she can still, however, record a digital information packet on an analog or digital audio tape. That digital information could then be sent to the exchange system using the same technique described before. In this case, rather than a menu-driven method of locating the information, the consumer may use a known address to send the information to the recipient. The recipient of the digital information packet at element 11 may store the data in RAM or perhaps in a tape format. The consumer at element 13 does not require a DAT player; a regular analog tape player suffices. In that case, however, the modular expandable unit to which it would be connected would need to be equipped with an analog-to-digital converter which could convert the data on the tape to a form usable by the modem. As stated before, this is because the bandwidth needed for most music is about 20 kHz while the bandwidth usable by a telephone is on the order of 4 kHz.

In addition to audio data, the modular expandable unit could also interface with video data devices and computer data devices through appropriate expansion modules 24. Examples of appropriate expansion modules for video data are those that would interface with devices using VHS tapes, Beta tapes, VHS-C tapes, and 8 mm tapes. Examples of appropriate expansion modules 24 for specialized video data are those that accommodate high-resolution video/graphics screens. Examples of appropriate expansion modules 24 for computer data are those that accommodate devices using parallel ports, serial ports, printers, magnetic disks, magnetic diskettes, magnetic tape, flash RAM, EPROM, and ramdisks. Of course, for all of the above varieties of data, if the data type is initially analog, it must be converted to one of the standard digital formats prior to being published on the exchange. This analog-to-digital

converter can be a separate module attached to the modular expandable unit and may be bidirectional.

5 The modular expandable unit 14 is capable of receiving digital information packets from the exchange system 1 over the selected transmission medium 5. After the subscriber requests a particular digital information packet, the requested digital information packet is transferred to the modular expandable unit via the selected transmission medium. The received requested  
10 data could be played in real time, could be stored in temporary memory for a later one-time-only play, or could be directed through an appropriate expansion module 24 to a particular recording device, such as those named above, where it may be recorded and thereafter repeatedly  
15 played.

The modular expandable unit would further be capable of recording and playing back digital information packets received from the exchange system 1. Once the digital information packet has been received by the modular  
20 expandable unit 14, it is directed to an expansion module 24 which acts as an interface for a particular device which is related to the type of data received. For example, if the requested digital information packet is a computer program, the MEU 14, through the appropriate  
25 expansion module 24, could store the program onto a hard disk or diskette. In this same example, if a computer program required a particular operating system with which to run, the operating system could also be downloaded as a separate digital information packet. In addition, if  
30 the publisher desires, a copy-inhibit feature could be included by the publisher and would be transmitted along with a particular digital information packet to prevent software piracy.

35 The received data can then be sent from the MEU 14 to any of the devices that can use digital data and are connected to the expansion modules 24 as described above.



In the example shown in FIG. 1, a subscriber at element 14 may wish to receive a digital information packet from publisher 11. This digital information packet could, for example, be music which is to be dubbed  
5 onto a home videocassette. In this case, the transfer would be similar to that described above. The music would be replayed at element 11, buffered, sent over the phone line 5 to the exchange system 1, and then sent to the modular expandable unit 14 to be re-buffered at 21  
10 and output as a digital information packet in the same form as it was played by the publisher. This digital information can then either be sent, in this example, to the digital audio input of a videocassette recorder, or can be first sent to a digital-to-analog converter, and  
15 then sent to the analog audio input of a videocassette recorder.

In the example shown by FIG. 1, the publisher at 15 could be a software publisher who sells software products over the DICE to subscribers. A subscriber at element 12  
20 could use the same menu-driven process as described above to request a particular digital information packet, in this case a software product. The program might then be uploaded from the publisher to the exchange system 1 and sometime later downloaded to a requesting subscriber.  
25 This type of transfer would be considerably quicker and simpler than the above-mentioned transfer of video and audio digital information packets, because there is usually much less information contained in this type of digital information packet.

30 In another embodiment, two private individuals may use DICE to exchange a digital audio recording. Letters "A," "B" will denote two different subscribers at two remote locations. Assume both individuals have one MEU containing the following: a primary interface expansion  
35 module, an LCD display pad, a keypad, two POTS expansion modules, one RAM expansion module, one digital audio expansion module with a digital audio input and output,

and one flash-file expansion module. Individual A has a DAT system and two POTS telephone lines. Individual B has a home entertainment center, including a stereo and two POTS telephone lines. Subscriber A would like  
5 subscriber B to hear an excerpt of his latest musical composition. Thus, A contacts B via voice phone. Subscriber A asks subscriber B if he is ready to receive and B responds affirmatively. Then, both subscribers hang up the line. At this time, subscribers A and B  
10 connect their two POTS lines to each of their respective MEUs. Individual A has stored his compressed digital recording in RAM on his MEU and (selecting from a series of menus displayed in the MEU LCD) programs his MEU to transfer the recording from his MEU to the phone number  
15 of B. Subscriber A sends information informing the MEU of subscriber B of what resources (e.g., phone numbers) are available. It then asks the MEU of subscriber B for similar information.

It is now the job of subscriber A to determine that  
20 it can transfer data over a dedicated line to MEU B. In doing so, once this acknowledgment is made, subscriber A dials up subscriber B along one of the dedicated lines. Once a connection has been made, subscriber A allocates a percentage of data to send over each line (50% is the  
25 case shown if both lines have identical characteristics). Subscriber A partitions the data, encrypts it, and queues each of the chunks to the POTS expansion modules. Subscriber A informs the MEU of subscriber B of the intended transfer over one of the dedicated lines.  
30 Subscriber A further signals the POTS expansion modules to commence a simultaneous transfer over the dedicated lines. Subscriber B encrypts the data and re-integrates it from the two POTS modules into RAM. After this, subscriber B may then hang up the dedicated line as well  
35 as can subscriber A. Subscriber B may see a displayed message that the transfer is done and complete and may unplug from both POTS lines. Subscriber B further may

pull the stereo line out of his MEU and the selection may be used to play the RAM resident data through his stereo output. The transfer is completed and subscriber B is able to listen to an excerpt of musical composition from subscriber A.

A virtual menuing means or system is also provided for a remote interface to information systems. Such a system has three components. First, the host device contains the complete menu. The client has a device linked to the host by an arbitrary telecommunications link, which receives discrete portions of the menu from the host, presents this to a user, and relays selection codes from the user to the host in the context of the menu.

The client implements a "menu window" over the larger host-based menu, which contains only a subset of the menu items available at the host. This window at the client can be moved dynamically over the full range of the host-based menu, providing access to all menu items. Traversal of the host-based menu need not be in contiguous increments, however. To solve the problem of making an arbitrarily long list of menu items accessible to a client, menu items are presented in a manner analogous to a voice mail type of menu, with a touchtone keypad. This specific scenario might be handled at the client. Clients which use the virtual menuing system described here would maintain the following information:

- (1) a "range" of "floating" items R representing the traditional scrolling area of a menu, and
- (2) a range of "hot key" items H that remain at a fixed location regardless of any scrolling of the floating items.

The number of menu items (M) in a host may be equal to nine (corresponding to touch tone digits 1-9). The number of "hot key" (H) items visible in the client menu may be equal to three (corresponding to the touch tone keys \*, 0, and #), which are typically special function

keys in a voice menu. The value of M is arbitrary. In general practice, M is greater than or equal to the floating range number of items (R), which are the number visible at one time in the client's menu. If not, no scrolling would be necessary at the client, and only M less than R would be valid menu choices, with the balance remaining as unused and displayed as blank items. The number of hot key items actually used can be any number less than or equal to H.

10       The host maintains a menu as a single contiguous list of items. Each item has at least an ASCII string identifier and an index number unique to the item. Typically, such numbers would start at "1" and increase for each item but any such arrangement is possible.

15       The total number of items displayed at the client equals the number of floating items plus the number of hot key items. The sum is the number of items actually displayed on the interface of the client device. The floating and hot key items are maintained in contiguous arrays. Clients communicate their configuration with regards to the number of each type of item to the host.

20       For a given client, the host maintains a menu base indicator, representing which item in its menu list the client has displayed as the first item in the floating area. It also knows the floating range of the client. So the current main chunk seen by the client is the range of items starting from the base. Aside from the number of hot keys transmitted once for the menu, the host sends chunks of range R items. The configuration also includes information regarding the scrolling increment of the client wishes to use.

25       The hot keys could perform any number of functions. In the case of a 100-item menu, with a floating range of ten items, if the user was at the beginning of the menu, and used a hot key function to zoom to the end, the host could simply set its base to item 91, directly from item 1, and send items 91 to 100, thus saving the transmission

30       

35

of the intervening 80 items. In a typical scenario, a 100 item menu might be rare, and even considered a poor design. As the market for interactive and on line content evolves, however, large menus representing  
5 catalogs of content will be quite commonplace.

In general, the system implements a two-way data stream between the host and client. The host transmits menu chunks, as well as updates to individual or small numbers of menu items, to the client, while the client  
10 sends selection codes to the host. The selection codes include tokens representing the various hot keys, as well as navigation codes such as Up, Down, In, Out, (for hierarchical menu navigation), Select, and Zoom.

The following codes are examples of those that may  
15 be sent from the client to the host in response to user actions at the client.

#### SelectUp

20 If the current menu item at the host is greater than one, it is decremented by one. If the resulting current menu item is less than the base, the base is decremented by the client's scroll increment, and the menu chunk from the base item of R items is transmitted to the client.  
25 The client displays the new menu chunk, effecting a scroll up.

#### SelectDown

Similar to SelectUp, except the current item is  
30 incremented if it is less than M. If the current item exceeds the item computed by adding the range R to the base, then the base is incremented by the client's scroll increment and the menu chunk is transmitted from the base item of R items to the client. The client displays the  
35 new menu chunk, effecting a scroll down.

**SelectIn**

If the current menu items is itself a menu, the host is initialized with the new menu information, and a menu definition is transmitted containing summary information  
5 on the new menu to the client, which clears its display. The host base is set to item one. If there are items in this menu, then the menu chunk is sent starting from the base. The client displays the new menu.

**10 SelectOut**

If the client has navigated inside a sub-menu, that menu is unloaded recovering the previous menu, initializing the host to base one, and a new menu definition is transmitted. Further, the first menu chunk is sent to  
15 the client. The client displays the menu which contained the menu it previously displayed.

**SelectCurrent**

This signals the host to perform some operation related  
20 to the menu item currently highlighted in the client menu. This is the current menu item at the host. The action triggered is determined by the host.

**SelectZoom (i: 1, = i, = R)**

25 This sets the current menu item at the host to correspond to the client menu item within the client's currently displayed floating range, which is indicated by the value of i. The current item is computed by adding i to the base and subtracting 1.

30

**Select HotKey**

Any number of predefined functions could be tied to hotkey codes. There are three types of menu transmissions from the host to the client. Each current  
35 menu item is highlighted in the client display.

### Menu Definition

This includes information on how many columns to display in the menu, and what the labels of such columns are (if there are multiple items per row). One row is still  
5 considered one menu item. Each row may have multiple segments, with each segment applying to a column in the definition. It might also include information on hotkey items.

### 10 Menu Chunk

This represents a complete range of menu items. If a client was configured with a floating range of nine items, then each menu chunk would contain the data for the nine rows of the menu, including all row segments for  
15 each item.

### Menu Update

Data included in this message can be used to alter the display of individual menu items without redrawing a  
20 complete menu range, or to change the information on hotkey functions. It would be used to immediately add a check mark to an item that was selected using SelectCurrent. Although the client might do this himself, if he waits for the host to send a Menu Update,  
25 the client reflects the actual state of the host.

The present invention is well-adapted to the recent development of multimedia microprocessors. For example, AT&T's 32-bit Hobbit microprocessor has a built-in  
30 communications ability, as well as a multitude of connectivity products being designed for it. These include applications allowing users to interact with multimedia in real-time over telephone lines. Such a microprocessor would well serve the needs of a digital  
35 information commodities exchange and in particular the MEU. Depending on the connectivity of the products that are designed for the Hobbit microprocessor and its built-

in communications facilities, the need for elaborate buffering of data may be less necessary than envisioned above. For example, the Hobbit microprocessor's communications abilities may be used to simplify much of the transmissions requirements.

Menu-driven software on the MEU would allow users to request digital information packets. This software interacts with software running on the exchange. Communications software on the exchange and on the MEU coordinates the transmission of digital information packets between them.

The menu-driven software could first request a publisher/subscriber's identification number and password for verification. The software would then inquire whether the publisher/subscriber chooses to publish a digital information packet, subscribe to a digital information packet, or gather information about a digital information packet.

If the publisher/subscriber chooses to subscribe to a particular digital information packet, he or she would conduct a search to find that digital information packet by maneuvering through one or more menus and thereupon requests it. If a publisher/subscriber wishes to post a publication on the exchange, he/she also "logs in" but then inputs the particulars of his/her publication. The menu-driven software can be similar to that used, for example, by the Prodigy® Network where the user first views a menu with a choice of different types of news stories, such as business news, politics, sports, etc. Once the subscriber chooses a particular type of story, the subscriber is then presented with another menu with a choice of other stories, all within that same type of news. After choosing a story from this menu the user is then actually looking at the text of a news story. Alternatively, a program similar to Apple® Computer's Applesearch® program could be employed to facilitate key word searches of data. Applesearch® is also used to rank



the retrieved documents by relevance. In the present system, the user would have a menu with choices of different types of data to request. These menus would ask the user if the information requested is textual, 5 visual, aural, etc. or a combination of these. The categories would further divide into news, music, movies, educational, and other subdivisions. After several iterations of choices, the user would find the appropriate digital information packet, and request it. 10 The user further could specify to what device the digital information packet is to be sent. The exchange system, after verifying the functionality of all the appropriate ports, would arrange the transfer, from the digital information commodities exchange, of the requested 15 digital information packet to the subscriber's MEU where it would be directed to the expansion module associated with the specified attached device, and optionally would bill the subscriber accordingly.

If the publication is meant for real-time access and 20 the publisher is connected to the exchange at all times, then the information could be routed from a publisher to a subscriber at any time the subscriber chooses. If this publisher is only intermittently connected to the exchange system, then the subscriber would wait until the 25 publisher is on-line again before the data could be requested and transferred from the publisher through the exchange system 1 to the subscriber. Alternatively, if the publisher has stored his or her publication on the exchange, the digital information packet would be 30 available whenever a subscriber wishes to subscribe to it. In any case, after the subscriber specifies the digital information packet to be sent, notification of the time of sending, whether immediate or in the future, would be given to the subscriber.

35 If the publisher/subscriber chooses to publish a particular digital information packet, occasionally in response to a subscriber request, he or she could replay

the digital information packet and also describe to the exchange system 1 what the electronic standards are for replaying the data. The publisher also specifies price and distribution information. The publisher then  
5 specifies to which subscriber the digital information packet is to be sent. The exchange system again verifies the functionality of the selected ports. The digital information packet is then sent through the exchange system to the subscriber. Billing information is again  
10 recorded.

To verify the integrity of a received digital information packet, a data flag could be put on to the end of the digital information packet. The flag would thus notify the exchange that the entire packet was  
15 received. The publisher/subscriber would then choose to publish another packet, request a packet, or disconnect the call.

The invention describes an exchange where the traded commodities are digital information packets. The digital  
20 information packets consist of a wide variety of different types of data. A relatively large number of publishers can make available a number of different data types to an equally wide variety of subscribers. The subscribers, via their modular expandable units with  
25 menu-driven software, can specify which digital information packets they would like to receive, in which format they would like to receive the data, and whichever transmission media they may prefer. Once the exchange is made aware of the subscriber's request, it sends the  
30 requested digital information packet to the subscriber. The exchange system records information about all the publication/subscription transactions and bills the publishers and subscribers accordingly.

WHAT IS CLAIMED IS:

1. A system for the exchange of digital information packets, comprising:

5 an exchange including a plurality of connectors for interfacing said exchange to a plurality of transmission media;

10 a plurality of modular expandable units, each of said plurality of modular expandable units having at least one input source terminal, at least one output terminal, and a central processing unit between said at least one input and said at least one output terminals; and

at least one transmission medium;

15 wherein said plurality of modular expandable units are connected to said exchange through said transmission medium to allow the first transfer of a user-selected amount and type of digital information from a first one of said plurality of modular expandable units to a second one of said plurality of modular expandable units,

20 and wherein said plurality of modular expandable units are connected to said exchange through said transmission medium to allow the second transfer of a user-selected amount and type of digital information from the second one of said plurality of modular expandable units to at least a third one of said plurality of modular expandable units,

25 such that said first one of said plurality of modular expandable units is capable of transferring data to said second one of said plurality of modular expandable units over two transmission media simultaneously.

35 2. The system for the exchange of digital information packets of claim 1, wherein said input source terminal includes a module selected from plurality of expansion modules, each of which can accommodate one variety of signal input.

3. The system for the exchange of digital information packets of claim 1, wherein said output terminal include a module selected from a plurality of available expansion modules, each of which can  
5 accommodate one variety of signal output.

4. The system for the exchange of digital information packets of claim 1, wherein said central processing unit includes:  
10 software running on a microprocessor suitable for selecting digital information;  
a system for entering commands;  
an input;  
an output; and  
15 a serial line;  
such that said serial line connects said at least one input to said at least one output.

5. The system for the exchange of digital information packets of claim 1, wherein said central processing unit includes:  
20 software suitable for selecting digital information;  
a system for entering commands; and  
a parallel line;  
25 such that said parallel line connects said at least one input to said at least one output.

6. The system for the exchange of digital information packets of claim 1, further comprising:  
30 an information buffer connected to said expandable module;  
such that said information buffer allows for the asynchronous communication of digital information between said exchange and one of said two modular expandable  
35 units over said transmission medium.

7. The system for the exchange of digital information packets of claim 1, further comprising:

an information buffer connected to said exchange;

such that said information buffer allows for the  
5 asynchronous communication between said exchange and one  
of said two modular expandable units over said  
transmission medium of digital information.

8. A method for the exchange of digital information  
10 packets, comprising:

(a) creating a digital information packet wherein  
the packet includes:

(i) a series string of data representing  
desired information;

15 (ii) a publisher address, corresponding to the  
location of a publisher creating said digital information  
packet;

(iii) a digital information packet directory  
entry, corresponding to a publishable address which is be  
20 used to locate and order said particular digital  
information packet;

(b) transmitting said digital information packet  
directory entry and said publisher address from a modular  
expandable unit to an exchange over a transmission  
25 medium;

(c) publishing said digital information packet  
directory entry and said publisher address over the  
exchange by filing and cataloguing, according to subject  
matter and type of medium supported, said digital  
30 information packet directory entry and said publisher  
address;

(d) compiling a list of said digital information  
packet directory entries and corresponding said publisher  
addresses;

35 (e) making available said list to subscribers with  
modular expandable units;

(f) locating a particular desired digital information packet by choosing one of said digital information packet directory entries from said compiled list over said exchange by using another modular expandable unit;

(g) subscribing to said digital information packet over said exchange by using one of said modular expandable units and providing information to said exchange, including:

(i) subscriber address where said digital information packet is to be sent;

(ii) the publisher address where said digital information packet is to be sent from;

(iii) the digital information packet directory entry where said digital information packet is stored;

(h) transferring said digital information packet from said publisher to said subscriber over said transmissions medium;

(i) concurrent with step (h), buffering said transfer of said digital information packet from said publisher to said subscriber such that said transfer occurs asynchronously.

9. The method of claim 8, wherein said steps of buffering of said transfer of said digital information packet is performed by both said publisher's and said subscriber's modular expandable units.

10. The method of claim 8, wherein said desired information is analog data which is then converted to digital form by an expansion module forming part of the modular expandable unit to provide said series string of data.

11. The method of claim 8 comprising the further step of:

storing said transferred digital information packet in a static semiconductor memory.

12. The method of claim 8 comprising the further  
5 step of:

storing said transferred digital information packet on a magnetic medium.

13. The method of claim 8 comprising the further  
10 step of:

playing said transferred digital information packet on a device appropriate to that data type.

14. The method of claim 8 comprising the further  
15 step of:

billing said subscriber for the transfer and price of said transferred digital information packet.

15. The method of claim 8 comprising the further  
20 step of:

billing said subscriber by said exchange for the transfer and price of said transferred digital information packet.

25 16. The method of claim 8, wherein said step of creating said digital information packet, occurs at the same time as said step of transferring of said digital information packet,

30 such that said transfer can be effected for real-time transmission of contemporaneously created data.

17. The method of claim 8, wherein data compression techniques are utilized to speed said transfer of said digital information packet.

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18. The system for the exchange of digital information packets of claim 1, further comprising an

expansion module coupled to said input source terminal, said expansion module accommodating a particular variety of signal input.

5        19. The system for the exchange of digital information packets of claim 1, wherein said exchange may be communicably connected to another exchange.

10       20. A system for the exchange of digital information packets, comprising:

an exchange including a plurality of connectors for interfacing said exchange to a plurality of transmission media;

15       a plurality of modular expandable units, each of said plurality of modular expandable units having at least one input source terminal, at least one output terminal, and a central processing unit between said at least one input and said at least one output terminals; and

20       at least one transmission medium;

wherein said plurality of modular expandable units are connected to said exchange through said transmission medium to allow the first transfer of a user-selected amount and type of digital information from a first one of said plurality of modular expandable units to a second one of said plurality of modular expandable units,

25       and wherein said plurality of modular expandable units are connected to said exchange through said transmission medium to allow the second transfer of a user-selected amount and type of digital information from the second one of said plurality of modular expandable units to at least a third one of said plurality of modular expandable units,

30       such that said first one of said plurality of modular expandable units transfers data to said second one of said plurality of modular expandable units over at least two transmission media simultaneously.



21. A system for the exchange of digital information packages comprised of:

an exchange including a plurality of modular expandable units (MEUs), where each of said MEUs includes:

a subsystem of circuitry having a plurality of IC's and memory devices;

a control bus connected to and used in tandem with said subsystem;

wherein said control bus provides regulated coherent access to at least one wide bandwidth high clock speed data bus such that said data is physically and logically separated within each of said MEU devices;

a plurality of expansion module interfaces, each of said interfaces providing a connection between said control bus and said data bus;

wherein said connection is dynamically completed or broken by said subsystem in accordance with requests transmitted over said control bus;

a plurality of connectors for interfacing said MEUs to a plurality of transmission media;

wherein said MEUs are connected to said exchange through said plurality of transmission media to allow the transfer of digital information from any one of said MEUs to any other of said MEUs.

22. The system for the exchange of digital information packets of claim 21 wherein one of said plurality of expansion modules transmits and receives information by said data bus and an external interface.

23. The system for the exchange of digital information pockets of claim 22, wherein said expansion module further comprises:

a microprocessor; and  
a memory device;

said microprocessor, said memory device, and said external connection operating in a first condition to convert digital information received from at least one external source connected to said external interface to  
5 a format to be transmitted to said expansion module interface;

and operating in a second condition to convert digital information transmitted away from said expansion module interface to a format to be received by at least  
10 one external device.

24. The system for the exchange of digital information packets of claim 21 wherein said subsystem is used to control said microprocessor.  
15

25. The system for the exchange of digital information packets of claim 21 wherein said transmission media is any assembly capable of transmitting digital information.  
20

26. The central processing unit of claim 4 where said software is microcode.

27. The central processing unit of claim 4 wherein  
25 said software is stored in EPROM.

28. The system of claim 21 wherein at least one of said MEUs is connected directly to at least one other of said MEUs over one transmission medium.  
30

29. The system of claim 28 wherein at least one of said MEU's is connected directly to at least one other of said MEU's over at least two transmission media.

30. The system of claim 1, further comprising means for virtual menuing.

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31. The system of claim 21, further comprising means for virtual menuing.

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FIG. 1

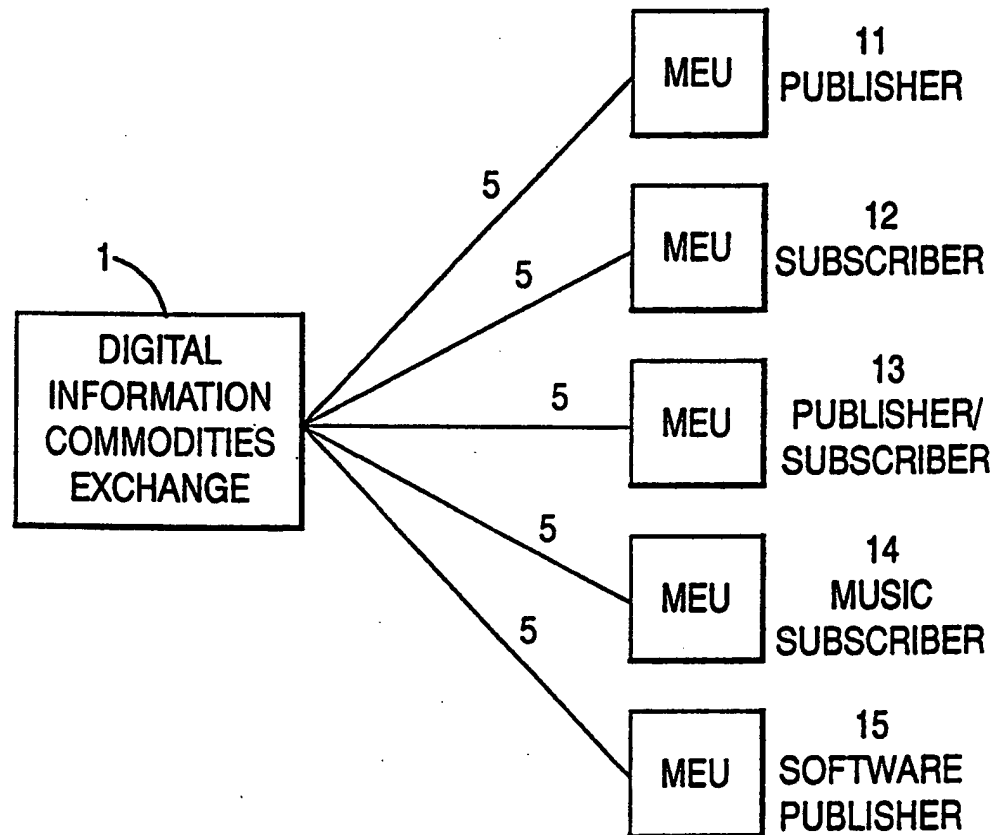


FIG. 2

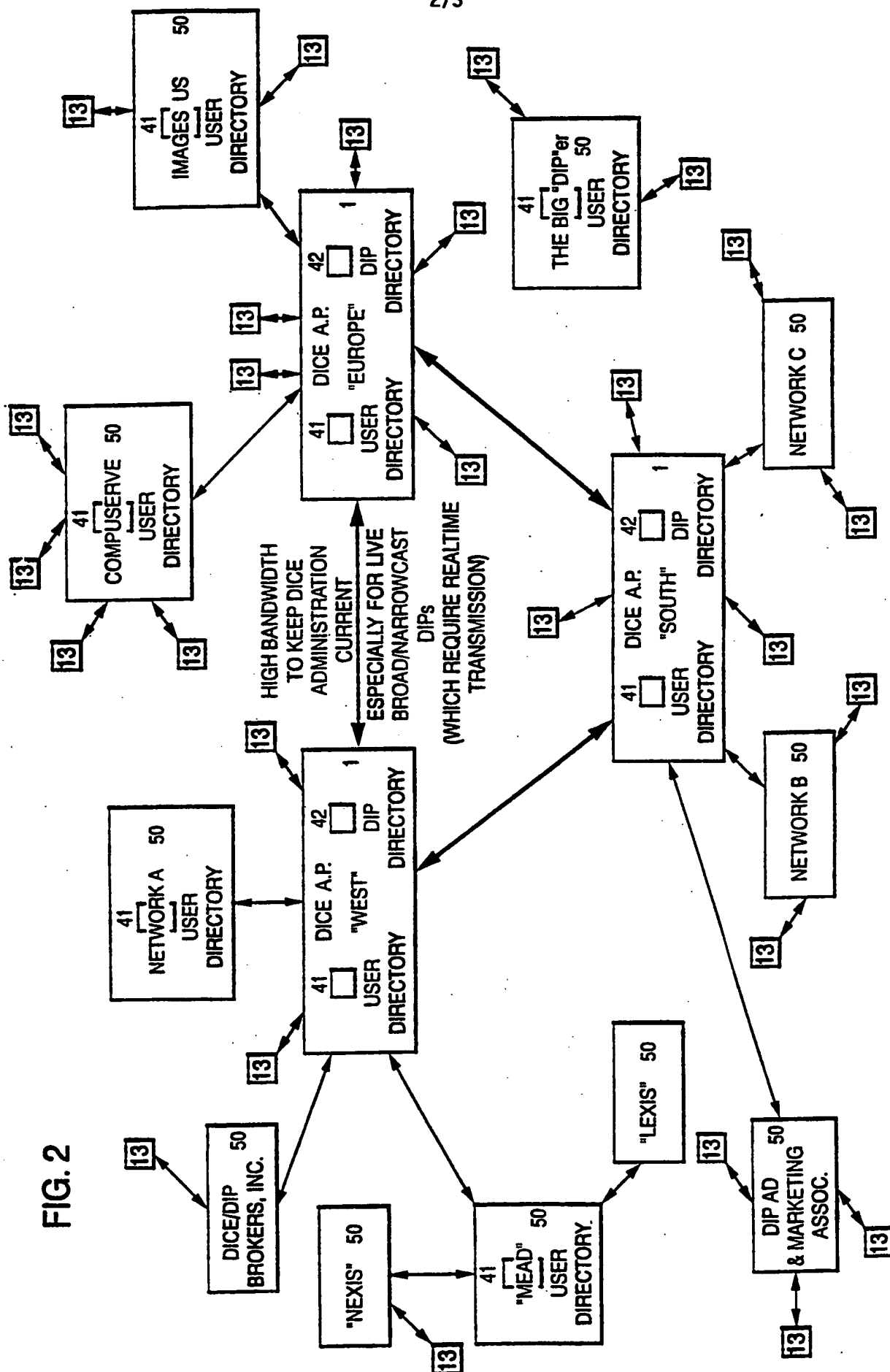


FIG. 3

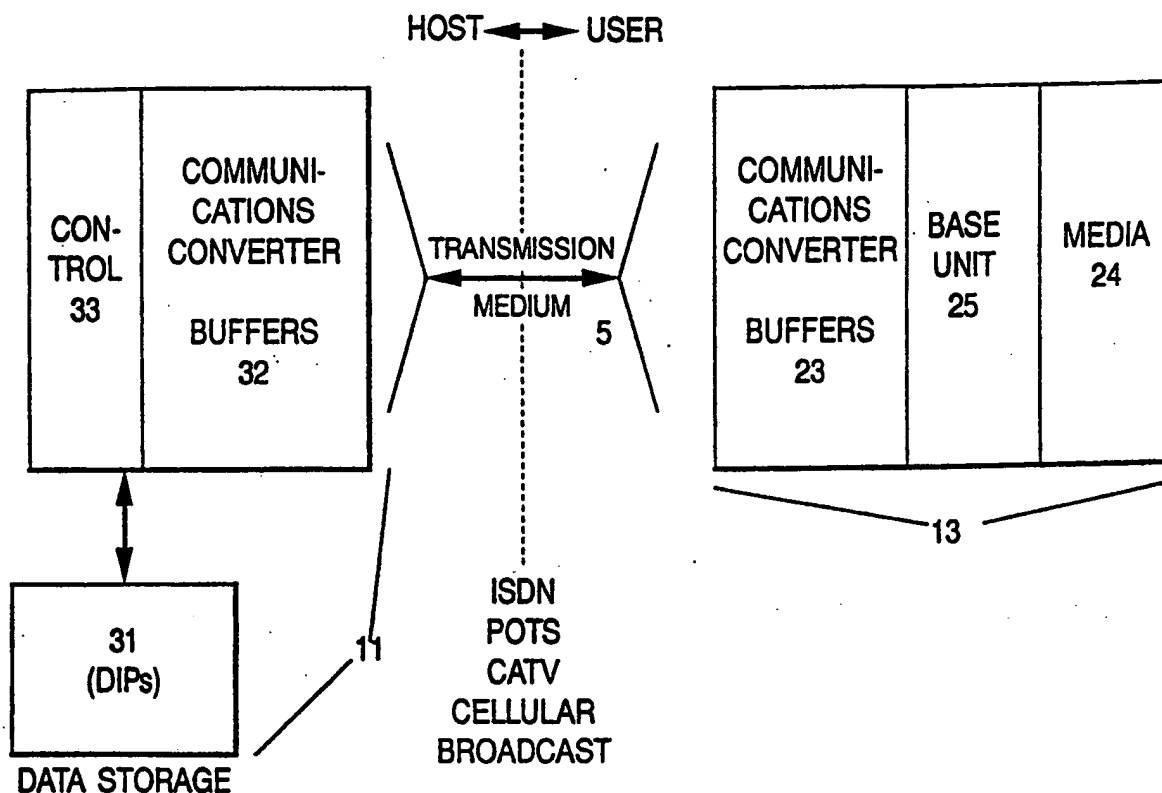
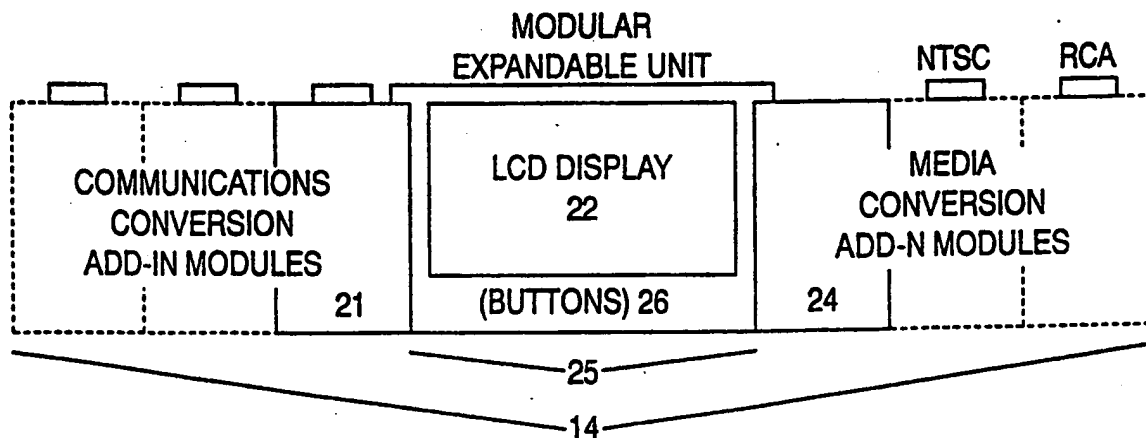


FIG. 4



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/US95/08159

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC(6) :H04B 13/00; H04J 3/26; H04L 12/40

US CL :370/60, 85.11, 85.11; 375/260

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 370/32, 53, 54, 58.1, 58.2, 60, 60.1, 61, 62, 85.1, 85.11, 94.1; 375/257, 260, 267; 348/6, 7, 8, 10, 12, 16; 379/110, 219, 220

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 4,491,983, (PINNOW et al) 01 January 1985, col. 3, lines 22-45, col. 4, lines 16-33, col. 4, line 44 to col. 5, line 20.	1-7, 18-20, 26-27 and 30
Y	US, A, 4,958,341 (HEMMADY et al) 18 September 1990, col. 6, lines 4-59 and figure 2.	1-7, 18-20, 26-27 and 30

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be part of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier document published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"g" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

13 SEPTEMBER 1995

Date of mailing of the international search report

17 NOV 1995

Name and mailing address of the ISA/US  
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# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US95/08159

## Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

## Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

### Telephone Practice

- I. Claims 1-7, 18-20, 26-27 and 30, drawn to an apparatus for exchanging information packets between plurality of modular expandable units over two transmission media. (375/260)
- II. Claims 8-17, drawn to a method for publishing directory entries and publisher address. (375/260)
- III. Claims 21-25, 28-29 and 31, drawn to a bus transmission system having a data bus and a separate control bus. (370/85.11)

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.